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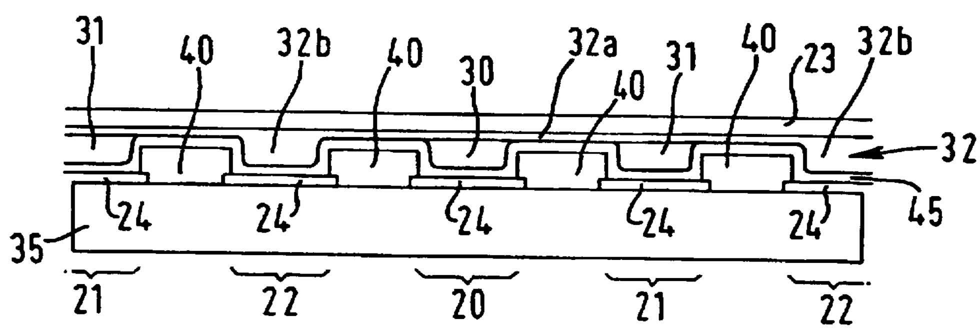
(54) Abstract Title
Organic electroluminescent displays

(57) The device has red, green, and blue electroluminescent regions (20, 21, 22) where red and green organic electroluminescent material (30, 31) is only formed in localised regions (20, 21). The blue organic electroluminescent material 32 may be deposited by spin coating to overlie the red and green electroluminescent regions in addition to the blue electroluminescent region (22). All electrode and an electron or hole transport material may also be applied to cover the red, green, and blue electroluminescent regions.

FIG. 2.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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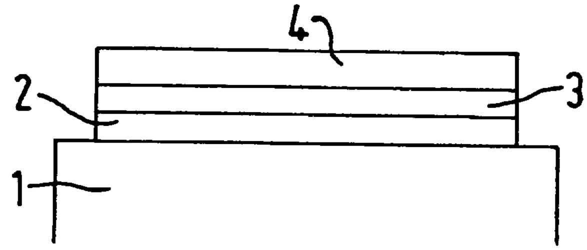


FIG. 1.

FIG. 2.

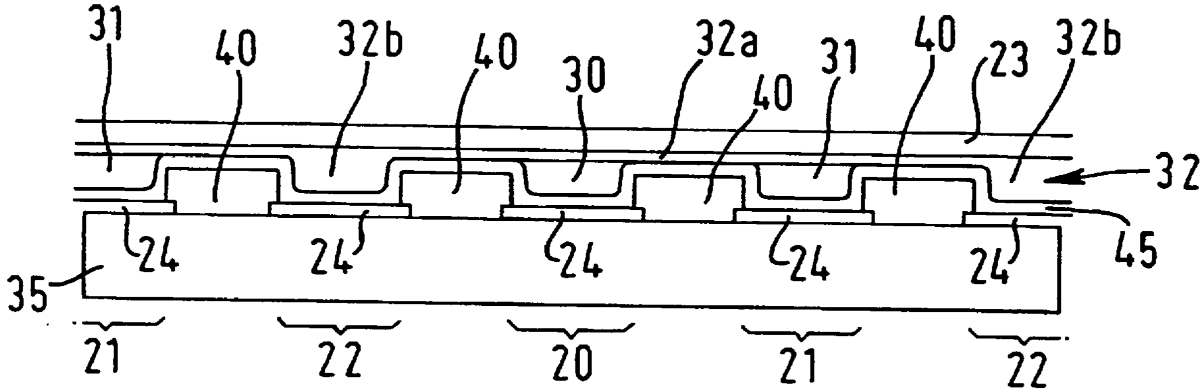
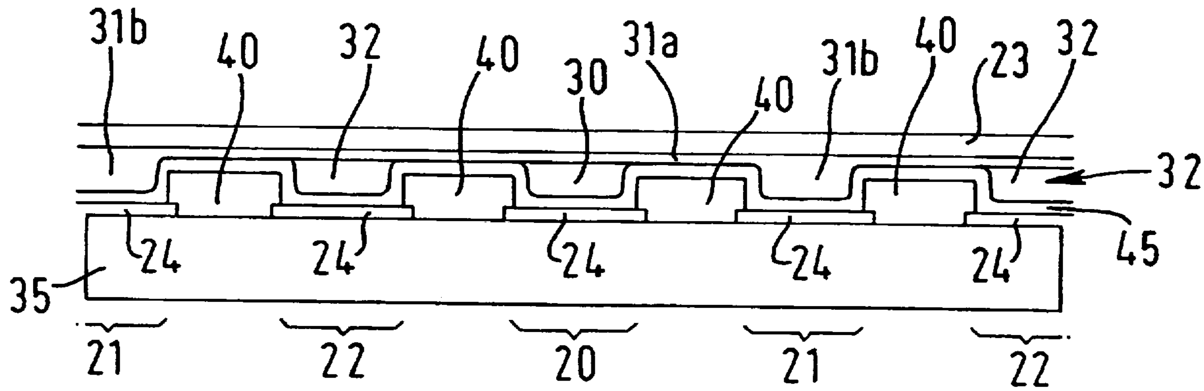


FIG. 3.



ELECTROLUMINESCENT DEVICES

This invention relates to electroluminescent display devices, especially multi-colour display devices, and methods for manufacturing display devices. The devices preferably comprise organic light-emissive material.

Light-emissive organic materials are described in PCT/WO90/13148 and US 4,539,507, the contents of both of which are incorporated herein by reference. The basic structure of these devices is a light-emissive organic layer, for instance a film of a poly(p-phenylenevinylene) ("PPV"), sandwiched between two electrodes. One of the electrodes (the cathode) injects negative charge carriers (electrons) and the other electrode (the anode) injects positive charge carriers (holes). The electrons and holes combine in the organic layer generating photons. In PCT/WO90/13148 the organic light-emissive material is a polymer. In US 4,539,507 the organic light-emissive material is of the class known as small molecule materials, such as (8-hydroxyquinoline)aluminium ("Alq3"). In a practical device, one of the electrodes is typically transparent, to allow the photons to escape the device.

Figure 1 shows the typical cross-sectional structure of an organic light-emissive device ("OLED"). The OLED is typically fabricated on a glass or plastics substrate 1 coated with a transparent first electrode 2 such as indium-tin-oxide ("ITO"). Such coated substrates are commercially available. This ITO-coated substrate is coated with at least a layer of a thin film of an electroluminescent organic material 3 and a final layer forming a second electrode 4 which is typically a metal or alloy. Other layers can be added to the device, for example to improve charge transport between the electrodes and the electroluminescent material.

Organic light-emissive materials have great potential for use in various display applications. Many displays include a plurality of individually controllable areas. Selected ones of the areas can be caused to emit, so that the device displays a

desired pattern. Each area can represent a pixel. Alternatively, each pixel can comprise more than one area. In the latter case the sub-pixel areas that make up a pixel can be controlled selectively so as to fix the pixel's brightness. If the sub-pixel areas of the pixel can emit two or more different colours then they can be controlled selectively so as to fix the colour that appears to be emitted by the pixel as a whole. In the most common arrangement, each pixel has red, green and blue emissive areas that can be controlled to provide the full spectrum of colours.

The pixels of display devices can be rather small – for example a typical pixel pitch for a laptop screen is of the order of 0.2mm, and in a typical three-colour display, in which each pixel comprises individual red, green and blue-light-emissive areas, the areas can be correspondingly smaller still. It is difficult to fabricate individual regions of organic light-emissive materials at a small scale. The problem is complicated further for multi-colour displays, where more than one emissive material normally needs to be deposited; this calls for emissive materials that are all compatible with the other features of the device and the other materials with which they must make contact, and are all capable of being deposited by the selected deposition process.

One potential solution for forming a three-colour display using three organic light-emissive materials is to deposit successive layers of the three materials over the whole of the device, removing after each deposition step the material in the areas where it is unwanted. This makes the deposition steps relatively easy, because a non-selective deposition process can be used to deposit a layer indiscriminately over the whole device. However, patterning the deposited materials precisely without affecting any underlying layers, especially underlying sensitive emissive layers, is very difficult. Another potential solution is to deposit each emissive material in just the areas where it is needed, using a selective deposition process such as ink-jet printing. This avoids the need for patterning after deposition, but it is difficult to develop formulations of the light-emissive materials that can be successfully ink-jetted, and compatible with the other materials of the device in which they are to be used, whilst still retaining superior optical and electrical

properties. Ink-jet printing of emissive materials is disclosed in PCT WO98/2427, the contents of which are incorporated herein by reference.

There is therefore a need for an improved method for forming display devices, especially multi-colour and/or small-scale devices.

According to a first aspect of the present invention there is provided a method for forming an electroluminescent device having first and second light-emissive areas, the method comprising: providing first electrodes at the first area and second areas; depositing a region of a first organic material at the first area by a selective deposition process such that none of the first organic material is deposited over the second area; depositing a region of a second organic material at the second area by a less selective deposition process such that the second organic material is also deposited at the first area; and providing second electrodes at the first and second areas.

The first organic material may suitably be a light-emissive material, a hole transport material or an electron transport material. Irrespective of the nature of the first organic material, the second organic material may suitably be a light-emissive material, a hole transport material or an electron transport material. It is preferred that the first and second organic materials are both the same one of those three types of material. One especially preferred configuration is for both the first and the second organic materials to be light-emissive materials.

There may be an additional organic material deposited by a less selective process at both the first and second areas. That additional organic material may be a light-emissive material, a hole transport material or an electron transport material. Preferably that additional organic material is a different one of those three types of material from the first and second organic materials. One preferred arrangement is for the first and second organic materials to be light-emissive materials and the additional material to be a hole or electron transport material. Another preferred arrangement is for the first and second organic materials both to be either hole or

electron transport materials and for the additional material to be a light-emissive material.

The first, second and (where present) additional organic materials could be deposited in any order.

Where the first and second organic materials are a light-emissive materials, the first organic material is suitably capable of emitting light of a different colour from that which the second organic light-emissive material is capable of emitting. For example, the first organic light-emissive material is suitably capable of emitting red, green or blue light and the second organic light-emissive material is suitably capable of emitting light of another of those colours. The device may also comprise a third light-emissive area for emitting light of a different colour from those which the first and second organic light-emissive materials are capable of emitting; for example another colour from the set of red, green and blue.

The first and second arèas, together with any optional third or subsequent area of a different emission colour, suitably provide a single pixel of the device. The device preferably comprises a plurality of such pixels. Preferably the pixels are arranged in an orthogonal array.

The first and second light-emissive areas are preferably spaced apart. The second organic light-emissive material is preferably also deposited between the first and second areas.

The method preferably comprises the step of forming a barrier at the first area for resisting spreading of the first organic material. The barrier may, for example, comprise a raised structure (for example of or coated with an electrically non-conductive material) or a region that resists wetting by the first organic material or a precursor thereof.

The selective deposition process preferably involves deposition over only one or more selected areas. The non-selective deposition process preferably involves deposition over all active areas of the device.

The selective deposition process is suitably a spot deposition process, and not a film deposition process, and is suitably capable of depositing selectively in a small area. The selective deposition process is preferably capable of depositing material in volumes smaller than 50pl, 40pl or 30pl and/or over areas smaller than $1mm^2$ or $0.5mm^2$ or $0.25mm^2$ and/or having an area of dimensions less than 1mm, 0.5mm or 0.3mm. The selective deposition process is suitably ink-jet printing.

The or each less selective deposition process is preferably incapable of depositing material selectively in a small area. The less selective process is preferably capable of depositing material relatively indiscriminately over an area. The less selective deposition process is preferably a film deposition process such as spin coating, blade coating meniscus coating etc.

The second organic material is suitably deposited over the first organic material.

The method suitably comprises the steps of: providing a first electrode at a third area; depositing a region of a third organic (most preferably light-emissive) material at the third area by a selective deposition process such that none of the third organic material is deposited at the first or second areas; and depositing a further electrode over the third area; and wherein the step of depositing a region of a first organic material is such that none of the first organic material is deposited at the third area; and the step of depositing a region of a second organic material is such that the second organic material is also deposited over the third area.

The third organic material is suitably capable of emitting light of a different colour from those which the first and second organic materials are capable of emitting. The second material is suitably deposited over the third material.

The second material is suitably capable of emitting light of a lower frequency colour that that which the first material is capable of emitting. For example, the first material may be a blue-light emitter and the second material a red- or green-light emitter; or the first material may be a green-light emitter and the second material a red-light emitter.

The second material is suitably capable of emitting light of a higher frequency colour that that which the first material is capable of emitting. For example, the first material may be a red-light emitter and the second material a blue- or green-light emitter; or the first material may be a green-light emitter and the second material a blue-light emitter.

All or any one or two of the organic materials may be a polymer light-emissive material, preferably a conjugated polymer light-emissive material. Alternatively, all or any one or two of the organic materials may be a small molecule material.

The first electrodes or the second electrodes may be common to three or any two of the first, second and third areas. The electrodes may be provided in the form of conductive strips that extend between two or more conductive areas of the device. If the electrodes are in the form of such strips then the first electrodes preferably extend orthogonally to the second electrodes. The areas may be addressed by an active or a passive matrix addressing scheme. To drive the emitters in an active matrix scheme the display preferably includes drive circuitry, preferably TFT (thin-film transistor) circuitry in the display panel.

According to a second aspect of the present invention there is provided a method for forming an electroluminescent device having first and second light-emissive areas, the method comprising: providing first electrodes at the first and second

areas; depositing a region of a first organic material at the first area by a selective deposition process such that none of the first organic material is deposited over the second area; depositing a region of a second organic material at the second area and co-depositing with that region a layer of the second organic material that extends from the second area to cover the region of the first organic material; and providing second electrodes at the first and second areas.

In either aspect of the invention the electroluminescent device is suitably a display device, preferably a pixellated device.

According to a third aspect of the invention there is provided an electroluminescent device having first and second light-emissive areas, the device comprising: first electrodes at the first area and second areas; a region of a first organic material at the first area, the first organic material being absent from the second area; a region of a second organic material at the second area and extending from the second area to cover the region of the first organic material; and second electrodes at the first and second areas.

Some preferred materials for components (where present) of the device are as follows:

- One of the electrodes (the hole-injecting electrode) preferably has a work function of greater than 4.3 eV. That layer may comprise a metallic oxide such as indium-tin oxide ("ITO") or tin oxide ("TO") or a high work function metal such as Au or Pt. The other electrode (the electron-injecting electrode) preferably has a work function less than 3.5 eV. That layer may suitably be made of a metal with a low work function (Ca, Ba, Yb, Sm, Li etc.) or an alloy or multi-layer structure comprising one or more of such metals together optionally with other metals (e.g. Al). At least one of the electrode layers is suitably light transmissive, and preferably transparent, suitably at the frequency of light emission from one or more of the light-emissive regions.
- The or each charge transport layer may suitably comprise one or more polymers such as polystyrene sulphonic acid doped polyethylene

dioxythiophene ("PEDOT-PSS"), poly(2,7-(9,9-di-n-octylfluorene)-(1,4-phenylene-(4-imino(benzoic acid))-1,4-phenylene-(4-imino(benzoic acid))-1,4-phenylene)) ("BFA"), polyaniline and PPV.

- The or each organic light-emissive material may comprise one or more individual organic materials, suitably polymers, preferably fully or partially conjugated polymers. Suitable materials include one or more of the following in any combination: poly(p-phenylenevinylene) ("PPV"), poly(2-methoxy-5(2'-ethyl)hexyloxyphenylenevinylene) ("MEH-PPV"), one or more PPV-derivatives (e.g. di-alkoxy or di-alkyl derivatives), polyfluorenes and/or co-polymers incorporating polyfluorene segments, PPVs and related co-polymers, poly(2,7-(9,9-di-n-octylfluorene)-(1,4-phenylene-((4-secbutylphenyl)imino)-1,4-phenylene)) ("TFB"), poly(2,7-(9,9-di-n-octylfluorene) - (1,4-phenylene-((4-methylphenyl)imino)-1,4-phenylene-((4 - methylphenyl)imino) - 1,4-phenylene)) ("PFM"), poly(2,7 - (9,9 - di-n-octylfluorene) - (1,4-phenylene-((4-methoxyphenyl)imino)-1,4-phenylene- ((4-methoxyphenyl)imino)-1,4-phenylene)) ("PFMO"), poly (2,7-(9,9-di-n-octylfluorene) ("F8") or (2,7-(9,9-di-n-octylfluorene)-3,6-Benzothiadiazole) ("F8BT"). Alternative materials include small molecule materials such as Alq3.

Preferably the dimensions of each emissive area are less than 1mm, and most preferably less than 0.5mm. The display is preferably generally planar, and in that case the area of each emissive area in the plane of the display is preferably less than 1mm^2 and most preferably less than 0.25mm^2.

It will be appreciated that the term ink-jet deposition refers to a type of deposition process and does not imply that the material to be deposited is an ink. Any implied orientation of the device is relative and is not necessarily related to its actual orientation during use or manufacture.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:

figure 2 shows a cross-section of part of a three-colour pixellated display device;

figure 3 shows a cross-section of an alternative embodiment of device, on a plane analogous to that of figure 2.

The figures are not to scale.

The device of figure 2 is a three-colour display device. The full device has numerous pixels, each of which comprises a red-light-emissive area 20, a green-light-emissive area 21 and a blue-light-emissive area 22. At each area is a region of an organic light-emissive material having a corresponding emission colour. The red-light-emissive material is indicated by 30, the green-light-emissive material by 31 and the blue-light-emissive material by 32. Cathode electrodes 23 (only one of which is shown in figure 2) and anode electrodes 24 are provided to allow the regions of light-emissive material to be addressed individually by a display driver to cause each pixel of the display to appear to emit a desired colour. The full display can thereby display a desired colour pattern.

Figure 2 shows that the red-light-emissive material 30 is discontinuous, and is located substantially only in the red-light-emissive areas, and that the green-light-emissive material 31 also discontinuous, and is located substantially only in the green-light-emissive areas. On the other hand, the blue-light-emissive material 32 extends in a continuous sheet 32a over a large area of the device, with thicker regions 32b in the blue-light-emissive areas. At the locations where they exist, the red- and green-light-emissive materials are overlain by the blue-light-emissive material. This structure provides the possibility to deposit the blue-light-emissive material by a less discriminate process than is needed to deposit the red- and green-light-emissive materials. For example, the red and green-light-emissive materials could be deposited by ink-jet printing whereas the blue-light-emissive material could be deposited by spin-coating. This provides substantial processing advantages, as will be discussed in more detail below.

The formation of the device of figures 2 and 3 will now be described in detail.

The layers of the device are deposited on to a substrate 35, which could be a glass or perspex sheet.

The anode strips 24 are formed of a light-transmissive (and preferably transparent) electrically conductive material such as ITO (indium-tin oxide). One example of an alternative material is TO (tin oxide). The ITO is patterned in strips 24 that run into the plane of figure 2. To form these strips the ITO could be selectively deposited on the substrate or the substrate could be covered with a layer of ITO, from which ITO is then removed to leave the desired pattern. ITO-coated glass substrates are commercially available.

Then separating banks 40 of an electrically insulating material such as polyimide or SiO_2 are deposited. These banks surround the regions that are to contain the light-emissive material, defining wells for receiving the light-emissive material. The banks also act to insulate each such region from adjacent regions. The banks overlap the edges of the ITO anode strips. This helps to define sharp edges to the light emission from the light-emissive regions.

Over the banks and the ITO is deposited a layer 45 of high-resistance PEDOT, which could, for example, be deposited by spin coating. This layer assists charge carrier transport from the anode strips to the light-emissive layers, improving efficiency of the device.

Next the red- and green-light-emissive materials are deposited selectively in the corresponding wells defined by the banks 40, to leave the red and green emissive regions 30 and 31. The red-light-emissive material could be a di-alkoxy PPV such as MEH-PPV and the green-light-emissive material could be PPV (e.g. prepared by the precursor route). To deposit the light-emitting material by ink-jet printing the material or a precursor of the material is sprayed into the appropriate groove through an ink-jet printer spray head. A suitable spraying cycle is 14,400 drops per second, with a drop volume of 30pl. The ink-jet system could be a continuous

stream system (e.g. using electrostatic directional control of the stream) or a drop-on-demand system using e.g. a piezoelectric or bubble-jet print head. The thickness of the deposited regions of the red- and green-light-emissive regions is preferably in the range from 20 to 200nm and most preferably around 100nm.

Over the red- and green-light-emissive materials and the remaining exposed PEDOT the blue-light-emissive material is deposited by spin-coating. The blue-emissive regions 32b to be used for emission of blue light in the completed device are located in the wells defined in the blue emissive areas by the banks 40. The blue-light-emissive material could be a polyfluorene such as F8 (poly (2,7-(9,9-di-n-octylfluorene)). The thickness of the deposited blue-light-emissive region is preferably in the range from 20 to 200nm and most preferably around 100nm.

The cathode electrode 23 is patterned in strips that run parallel to the plane of figure 2, and are spaced apart out of the plane of the figure. The cathode electrode could be formed by sputtering. The cathode layer could be a thin layer of calcium adjacent to the emissive regions, topped by a thicker layer of aluminium.

Finally, the device is encapsulated for environmental protection.

In operation, each emissive region 30, 31, 32b can be addressed by applying an appropriate voltage across the pair of electrodes that intersect at that region. In this way the region is caused to emit light. To achieve this the electrode strips 23, 24 can be connected to a display controller.

The layer of blue-light-emissive material 32a overlies the red- and green-light-emissive materials at 30 and 31, being interposed between them and the electrode 23. In this case the blue-light-emissive material acts as an electron transport layer to the red- and green-light-emissive materials.

In an alternative embodiment, illustrated in figure 3, the red- and blue-light-emissive materials are deposited by ink-jet printing and the green-light-emissive material is deposited by spin-coating. This embodiment has the advantage that the PPV green-light-emissive material can act to protect the other light-emissive materials from damage during sputtering of the cathode. This is especially significant where the PPV is prepared by the precursor route and is insoluble and more robust. In figure 3 like components are numbered as for figure 2, except that the blue-light-emissive regions are designated 32, the green-light-emissive regions are designated 31b and the overlying sheet of green-light-emissive material is designated 31a.

The principles described above may be applied to any suitable device having two or more organic layers, not just light-emissive layers. Where there are two or more selectively deposited layers they could be deposited by different methods - for example one by ink-jetting and the other by a differential wetting method as described below.

Both of these embodiments have a significant advantage over prior devices in which the regions of all three light-emissive materials are deposited by highly selective spot deposition process such as ink-jet printing or a process in which material must be removed to produce neat isolated regions. Since the embodiments of figures 2 and 3 allow one of the materials to be deposited by a less selective process there is no need for the material that is deposited by that less selective process to be specially tailored to be capable of ink-jet printing. Furthermore, the less selective process is likely to allow the regions of that material to be deposited essentially in a single step, permitting the device to be fabricated more quickly and with fewer defects.

The device could have more than three light-emissive materials, with correspondingly more emission colours available, or could have only two emissive materials. The emission colours of the materials could be other than red, green and blue.

The overall device may form the display of a larger electronic device such as a computer, television or telephone. The overall device may have several thousand pixels. For instance, one typical size is 800 columns by 600 rows, giving a total of 480,000 pixels. A typical pixel size is 300 x 100 μm, with each individual emissive area being correspondingly smaller.

As an alternative to the banks 40, a differential wetting principle could be used. The surface on to which the emissive materials are to be deposited could be treated with a wetting agent or a non-wetting agent to cause the materials to bead up into the desired formations over the anode strips.

The cathode could be located in front of the emissive regions (as seen by a viewer), with the anode behind them. In that case, the cathode should be of a light transmissive material.

As an alternative to the passive matrix drive scheme of the devices of figures 2 and 3, the device could be driven by an active matrix drive scheme. Indeed, an active matrix drive scheme may provide superior performance. To achieve this the electrodes could be configured, and if necessary the display provided with extra circuitry (e.g. thin-film transistor (TFT)) circuitry, to allow the display driver to use an active matrix addressing scheme.

One or more additional charge carrier transport layers, for instance of PEDOT-PSS or other materials could be located between the anode electrode and the light-emissive regions and/or between the cathode electrode and the light-emissive regions. These layers could help charge transport in the forward direction and/or help to block charge transport in the reverse direction. The same charge transport layer(s) could be used between the respective electrodes and all the emissive regions or specific charge transport layers could be used for each emissive material. Especially where the same material is used for the charge transport layer for all the emissive regions it may be found that in many cases the

device will perform acceptably if the charge transport layer is not patterned - thus a continuous transport layer may be used over the entire device. Where a charge transport layer is to be patterned it may be deposited uniformly and then patterned or may be deposited in a patterned form, e.g. by ink-jet printing. Other layers could be present such as barrier layers to counteract degradation of the device during use, conducting layers to improve charge distribution over the area of the device, insulating layers to inhibit unwanted charge migration, or protection layers to prevent degradation of parts of the device during manufacture. A single layer could perform more than one of these functions.

The present invention may include any feature or combination of features disclosed herein either implicitly or explicitly or any generalisation thereof, irrespective of whether it relates to the presently claimed invention. In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention.

CLAIMS

1. A method for forming an electroluminescent device having first and second light-emissive areas, the method comprising:

providing first electrodes at the first area and second areas;

depositing a region of a first organic material at the first area by a selective deposition process such that none of the first organic material is deposited over the second area;

depositing a region of a second organic material at the second area by a less selective deposition process such that the second organic material is also deposited at the first area; and

providing second electrodes at the first and second areas.

2. A method as claimed in claim 1, wherein the first organic material is a light-emissive material.

3. A method as claimed in claim 1, wherein the first organic material is a hole transport material.

4. A method as claimed in claim 1, wherein the first organic material is an electron transport material.

5. A method as claimed in any of claims 1 to 4, wherein the second organic material is a light-emissive material.

6. A method as claimed in any of claims 1 to 4, wherein the second organic material is a hole transport material.

7. A method as claimed in any of claims 1 to 4, wherein the second organic material is an electron transport material.

8. A method as claimed in any preceding claim, wherein the method further comprises the step of depositing a region of an additional organic material at the first and second areas.

9. A method as claimed in claim 8, wherein the additional organic material is a light-emissive material.

10. A method as claimed in claim 8, wherein the additional organic material is a hole transport material.

11. A method as claimed in claim 8, wherein the additional organic material is an electron transport material.

12. A method as claimed in claim 5 as dependant on claim 2 or any of claims 8 to 11 as dependant on claims 2 and 5, wherein the first organic light-emissive material is capable of emitting light of a different colour from that which the second organic light-emissive material is capable of emitting.

13. A method as claimed in any preceding claim, wherein the first and second light-emissive areas are spaced apart and the second organic material is also deposited between the first and second areas.

14. A method as claimed in claim 13, comprising the step of forming a barrier at the first area for resisting spreading of the first organic material.

15. A method as claimed in claim 14, wherein the barrier comprises a raised structure.

16. A method as claimed in claim 14 or 15, wherein the barrier is formed of an electrically non-conductive material.

17. A method as claimed in any preceding claim, wherein the selective deposition process is a spot deposition process.

18. A method as claimed in any preceding claim, wherein the selective deposition process is ink-jet printing.

19. A method as claimed in any preceding claim, wherein the less selective deposition process is a film deposition process.

20. A method as claimed in any preceding claim, wherein the less selective deposition process is spin coating.

21. A method as claimed in any preceding claim, wherein the second organic material is deposited over the first organic material.

22. A method as claimed in any preceding claim, comprising the steps of:

providing a first electrode at a third area;

depositing a region of a third organic material at the third area by a selective deposition process such that none of the third organic material is deposited at the first or second areas; and

depositing a further electrode over the third area;

and wherein

the step of depositing a region of a first organic material is such that none of the first organic material is deposited at the third area; and

the step of depositing a region of a second organic material is such that the second organic material is also deposited over the third area.

23. A method as claimed in claim 22 as dependant directly or indirectly on claims 2 and 5, wherein the third organic material is a light-emissive material that is capable of emitting light of a different colour from those which the first and second organic light-emissive materials are capable of emitting.

24. A method as claimed in claim 22 or 23, wherein the second organic material is deposited over the third organic material.

25. A method as claimed in any of claims 8 to 24 as dependant directly or indirectly on claims 2 and 5, wherein the second organic material is capable of emitting light of a higher frequency colour that that which the first organic material is capable of emitting.

26. A method as claimed in any of claims 8 to 24 as dependant directly or indirectly on claims 2 and 5, wherein the second light-emissive material is capable of emitting light of a lower frequency colour that that which the first light-emissive material is capable of emitting.

27. A method as claimed in claim 2 or claim 5 or any of claims 6 to 26 as dependant directly or indirectly on claim 2 or 5, wherein at least one of the light-emissive materials is a polymer light-emissive material.

28. A method as claimed in claim 27, wherein at least one of the light-emissive materials is a conjugated polymer light-emissive material.

29. A method as claimed in claim 2 or claim 5 or any of claims 6 to 28 as dependant directly or indirectly on claim 2 or 5, wherein at least one of the light-emissive materials is a small molecule material.

30. A method as claimed in any preceding claim, wherein the first electrodes are common to the first and second areas.

31. A method as claimed in any of claims 1 to 30, wherein the second electrodes are common to the first and second areas.

32. A method for forming an electroluminescent device having first and second light-emissive areas, the method comprising:

providing first electrodes at the first and second areas;

depositing a region of a first organic material at the first area by a selective deposition process such that none of the first organic material is deposited over the second area;

depositing a region of a second organic material at the second area and co-depositing with that region a layer of the second organic material that extends from the second area to cover the region of the first organic material; and

providing second electrodes at the first and second areas.

33. A method as claimed in any preceding claim, wherein the electroluminescent device is a display device.

34. A method for manufacturing an electroluminescent device, substantially as herein described with reference to figures 2 and 3 of the accompanying drawings.

35. An electroluminescent device having first and second light-emissive areas, the device comprising:

first electrodes at the first area and second areas;

a region of a first organic material at the first area, the first organic material being absent from the second area;

a region of a second organic material at the second area and extending from the second area to cover the region of the first organic material; and

second electrodes at the first and second areas.

36. An electroluminescent device substantially as herein described with reference to figures 2 and 3 of the accompanying drawings.

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Claims searched: 1-36

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Other: Online: WPI, JAPIO, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, Y	WO 98/24271 A1	(SEIKO) See figure 4	X:1, 2, 6-8, 10, 11, 13-22, 24, 27-29, 31-33, & 35 Y:3-5, 9, 12, 23, 25, 26, & 30
Y	US 5 681 756	(MOTOROLA) See figure 6	Y:3-5, 9, 12, 23, 25, 26, & 30

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.